PAMS Technical Documentation
NSM–3/3D Series Transceivers

Tuning Instructions

Issue 4 02/2002
© Nokia Corporation

CONTENTS

© Nokia Mobile Phones Ltd.

Tuning Instructions

General

All tuning operations are carried out using the service software. The service software turns the phone into the locals mode, in which the phone can be outwardly controlled via the MBUS interface.

Tuning is based on the software communicating with the D/A and A/D converters of the phone. In some instances the phone processor will also calculate the required correction parameter.

The tuning values of the phone reside on the EEPROM. The contents of the EEPROM can be read by the service software and saved as a file. This is advisable when there is need to retain that information, e.g. in view of replacement of the circuit. The program also enables writing the default parameters on the EEPROM, in which case all tuning steps should be carried out.

During tuning, proceed as follows:

- Take care not to damage sensitive measuring instruments with excessive RF power.
- Carry out all tuning steps in the shortest possible time to avoid excessive heating of RF units.
- Perform all tuning steps in the order presented.
- Never try to mask a fault by tuning it out!

© Nokia Mobile Phones Ltd.

Required Equipment

- PC with service software; see separate section for instructions on installation and use.
- Service accessories; see equipment setup pictures.
- Multimeter or DVM.
- GSM radio telephone test station or separate measuring equipment as follows:
    - RF generator
    - pulse power meter
    - spectrum analyzer
    - attenuator and branching unit

Equipment Setup

Caution: Make sure that you have switched off the PC and the printer before making connections !

Caution: Do not connect the PKD–1 key to the serial port. You may damage your PKD–1 !

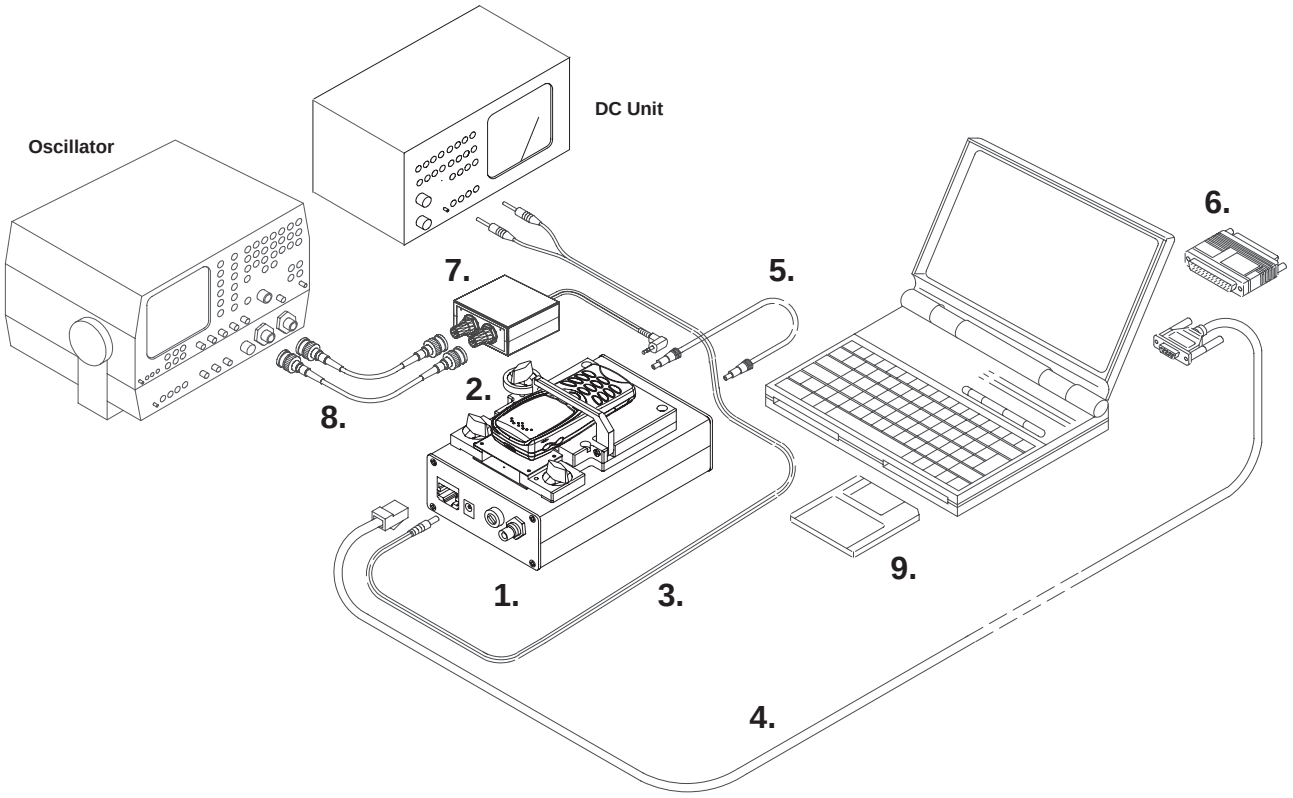
Attach the protection key PKD–1 to parallel port one (25–pin female D–connector) of the PC. When connecting the PKD–1 to the parallel port be sure that you insert the PC end of the PKD–1 to the PC (male side). If you use a printer on parallel port one, place the PKD–1 between the PC and your printer cable.

Next connect the M2BUS service cable, DAU–9S, to the serial port (RS–232) of the computer. Attach one end of the service cable to the PC serial port and the other end to the service box, JBU–6. For servicing the phone with the covers in place the service box should always be used.

When the phone covers are removed the jigs should be used.

© Nokia Mobile Phones Ltd.

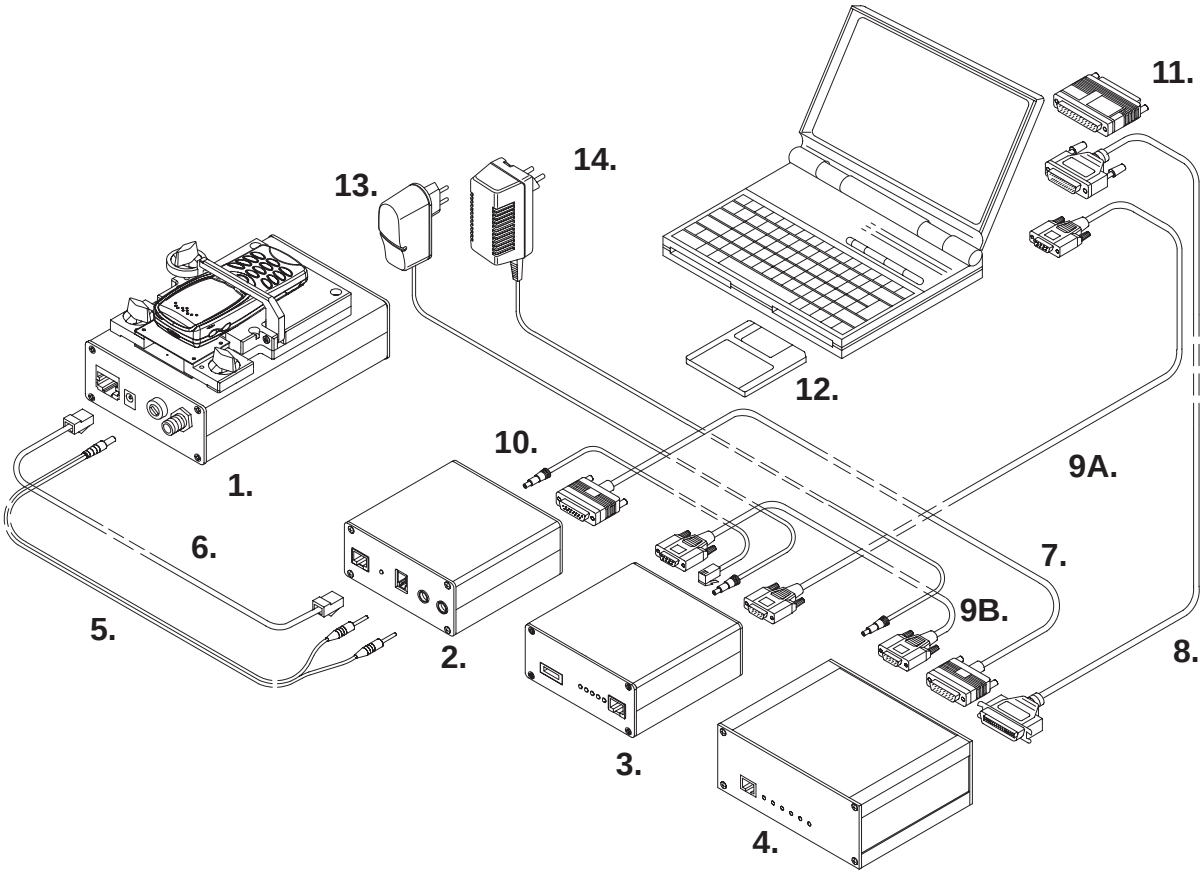
Equipment Setup for Testing Audio and Charging



Item:	Service accessory:	Product code:
1	Service Box JBU–6	0770153
2	RF Adapter RL6 for JBU–6	0770172
3	DC Power Cable PCS–1	0730012
4	Service MBUS Cable DAU–9S	0730108
5	DC–DC Cable SCB–3	0730114
6	Software protection key PKD–1	0750018
7	Audio Box JBA–6	0770184
8	Audio Cable ADS–3	0730197
5	Service SW diskette 3.5” for WinTesla	0774046
9	Service SW diskette 3.5” for NSM–3 (3D) Flash SW packages on CD	0774080 0775219

© Nokia Mobile Phones Ltd.

Flash Concept with JBU–6



Item:	Service accessory:	Product code:
1	Service Box JBU–6	0770153
2	Flash Loading Adapter FLA–7	0080326
3	Flash Security Box TDF–4	0770106
4	Prommer FPS–4S	0085095
5	DC Power Cable PCS–1 for JBU–6	0730012
6	Service Cable XMS–3	0730174
7	D15 – D15 Cable AXS–5	0730091
8	Printer Cable (Included in FPS–4 sales pack)	0730029
9A	D9 – D9 Cable AXS–4 (Included in FPS–4 sales pack)	0730090
9B	D9 – D9 Cable AXS–4	0730090
10	DC Cable PCC–1B	0730053
11	Software protection key PKD–1	0750018
12	Service SW diskette 3.5” for NSM–3 (3D)	0774080
	Service SW diskette 3.5” for WinTesla	0774046
13	Travel Charger ACH–6E (Euro)	0270381
	Travel Charger ACH–6U (USA/Japan)	0270382
	Travel Charger ACH–6X (UK)	0270380
14	AC Charger ACL–3E (Included in FPS–4 sales pack)	0680015

© Nokia Mobile Phones Ltd.

NOTE: Changes in Sales Packs

In FPS–4S sales pack ACL–3E will be replaced by AXD–1 power cable.This cable makes it possible to power the FPS–4 prommer with ACH–6 type charger. Same charger has been used to power TDF–4 Flash Security Box and it must be purchased separately.

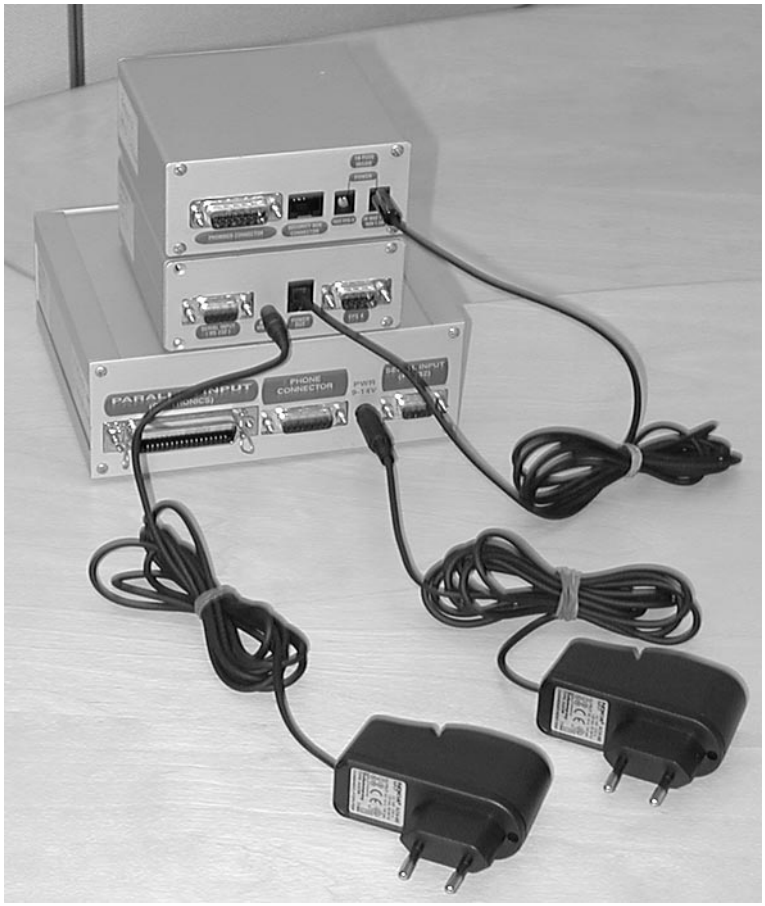
AXD–1 power cable will be added to FLA–7 sales pack. This makes it possible to power FLA–7 from TDF–4 power output or separate ACH–6 type charger.

Flash Concept Power Distribution Options

1. Two AXD–1 cables and two ACH–6 chargers – RECOMMENDED!
2. One ACH–6 and two ACL–3 chargers

1. Power distribution with two AXD–1 cables and two ACH–6 chargers:

FLA–7 powered by AXD–1 cable from TDF–4 “Power Out” connector
(It is also possible to power FLA–7 with AXD–1 and *separate* ACH–6).
TDF–4 powered by ACH–6 Charger.
FPS–4 powered by AXD–1 DC cable and ACH–6 Charger.

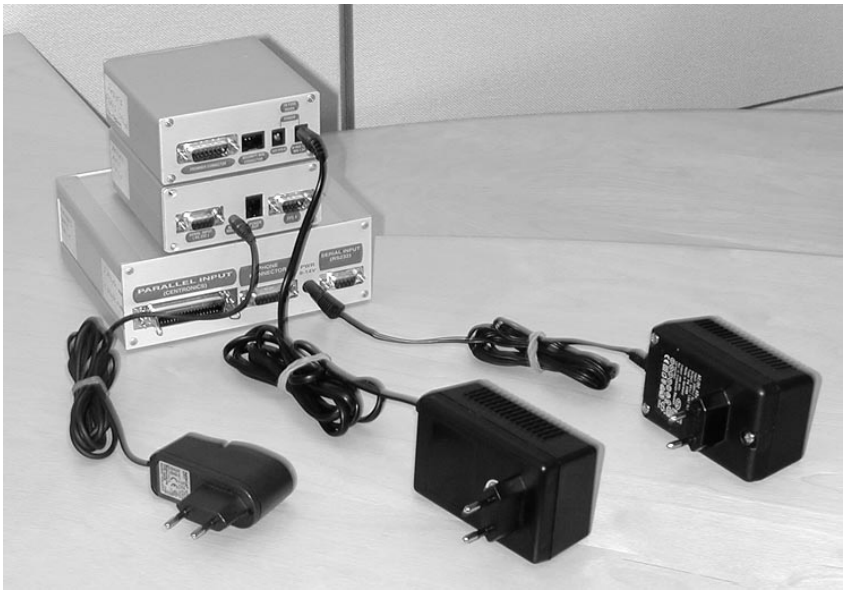


NOTE: Do not use SCF–7 cable to power FLA–7 and FPS–4 from one ACH–6 charger as done when using ACL–3!

© Nokia Mobile Phones Ltd.

2. Power distribution with one ACH–6 and two ACL–3 chargers:

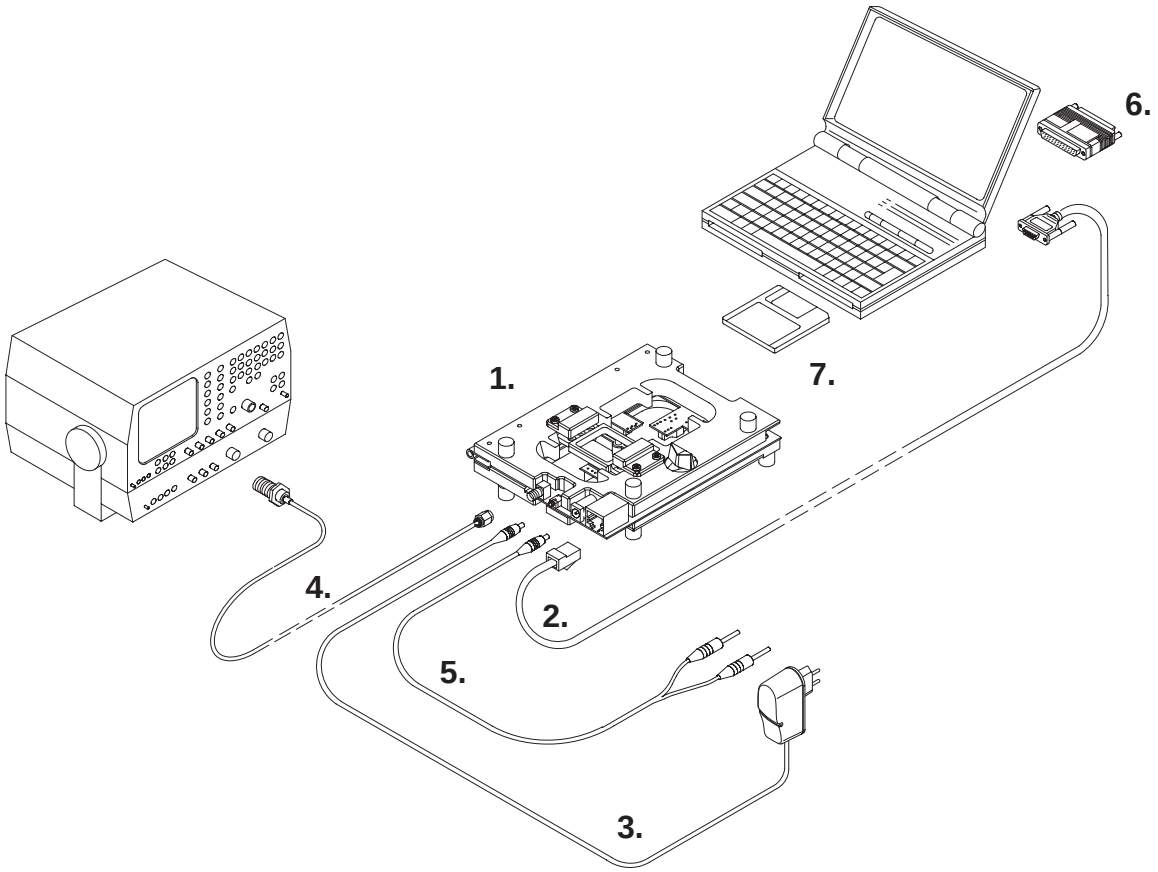
FLA–7 powered by ACL–3 charger
TDF–4 powered by ACH–6 charger
FPS–4 powered by ACL–3 charger



NOTE: It is recommended to use separate power supplies for FLA–7 and FPS–4.

© Nokia Mobile Phones Ltd.

Testing Without Covers – Using Test–frame MJS–9

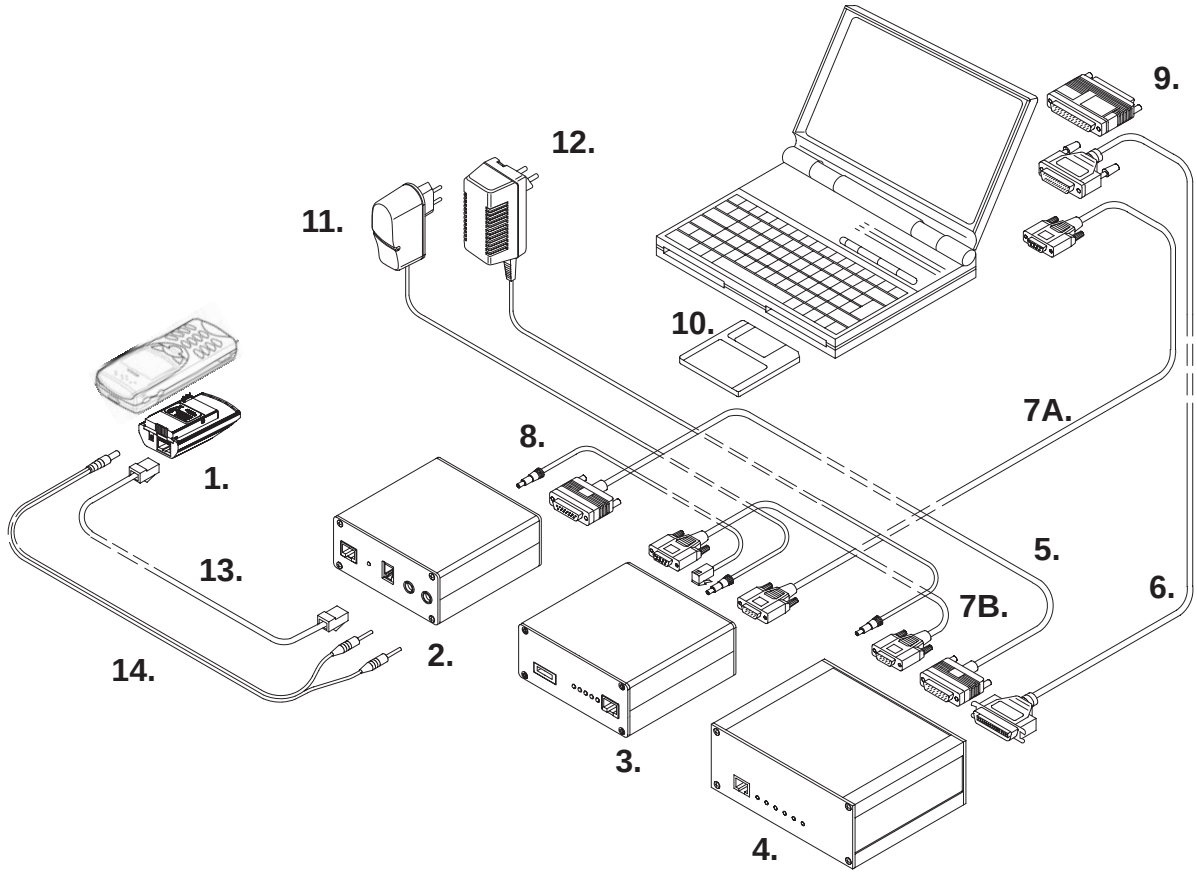


Item:	Service accessory:	Product code:
1	Module Jig MJS–9*	0750154
2	Service MBUS Cable DAU–9S	0730108
3	ACP–8 Travel Charger (see code: General Information chapter)	
4	RF Antenna Cable XRF–1	0730085
5	DC Power Cable PCS–1	0730012
6	Software Protection Key PKD–1	0750018
7	Service SW diskette 3.5” for WinTesla	0774046
	Service SW diskette 3.5” for NSM–3 (3D) Flash SW packages on CD	0774080 0775219

*) The nominal operating voltage for MJS–9 is 8.0 V.
The supply voltage for MJS–9 must never exceed 15.0 V

© Nokia Mobile Phones Ltd.

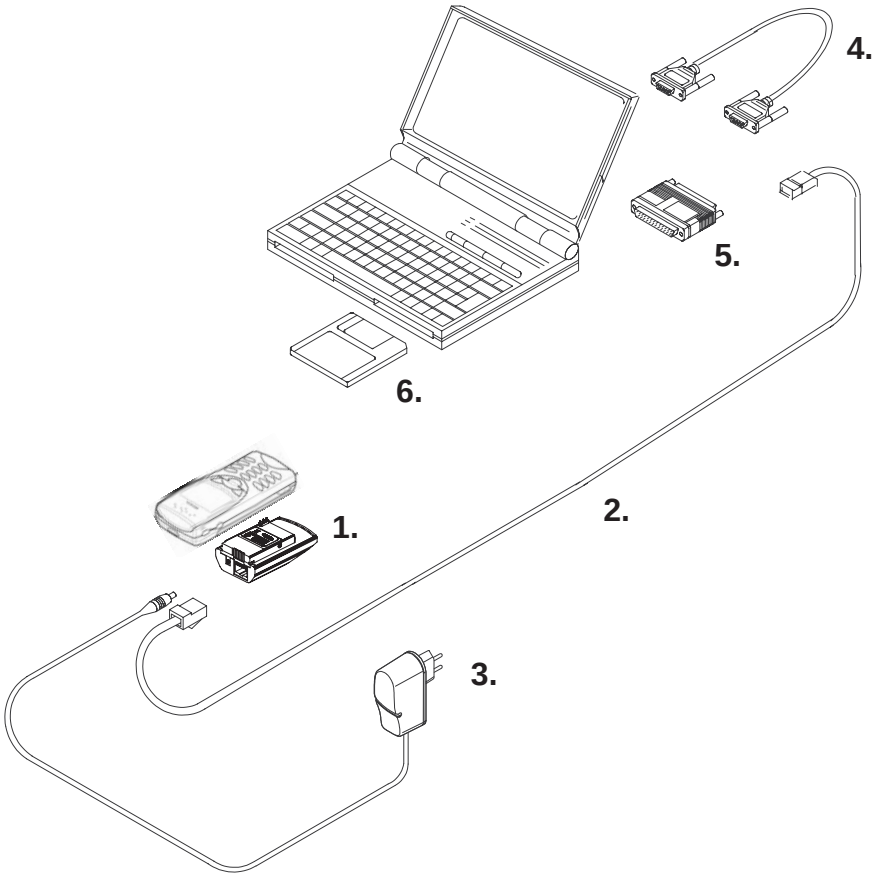
Flashing With FLA–10



Item:	Service accessory:	Product code:
1	Service Flash Adapter FLA–10 (Sales Pack)	0081346
2	Flash Loading Adapter FLA–7	0080326
3	Flash Security Box TDF–4	0770106
4	Prommer FPS–4S	0085095
5	D15 – D15 Cable AXS–5	0730091
6	Printer Cable (Included in FPS–4 sales pack)	0730029
7A	D9 – D9 Cable AXS–4 (Included in FPS–4 sales pack)	0730090
7B	D9 – D9 Cable AXS–4	0730090
8	DC Cable PCC–1B	0730053
9	Software protection key PKD–1	0750018
10	Service SW diskette 3.5” for NSM–3 (3D)	0774080
	Service SW diskette 3.5” for WinTesla	0774046
11	Travel Charger ACH–6E (Euro)	0270381
	Travel Charger ACH–6U (USA/Japan)	0270382
	Travel Charger ACH–6X (UK)	0270380
12	AC Charger ACL–3E (Included in FPS–4 sales pack)	0680015
13	Service Cable XMS–3 (XCM–5 included in FLA–7 Sales Pack)	0730174
14	DC Power Cable FLC–2 (Included in FLA–10 Sales Pack)	0730012

© Nokia Mobile Phones Ltd.

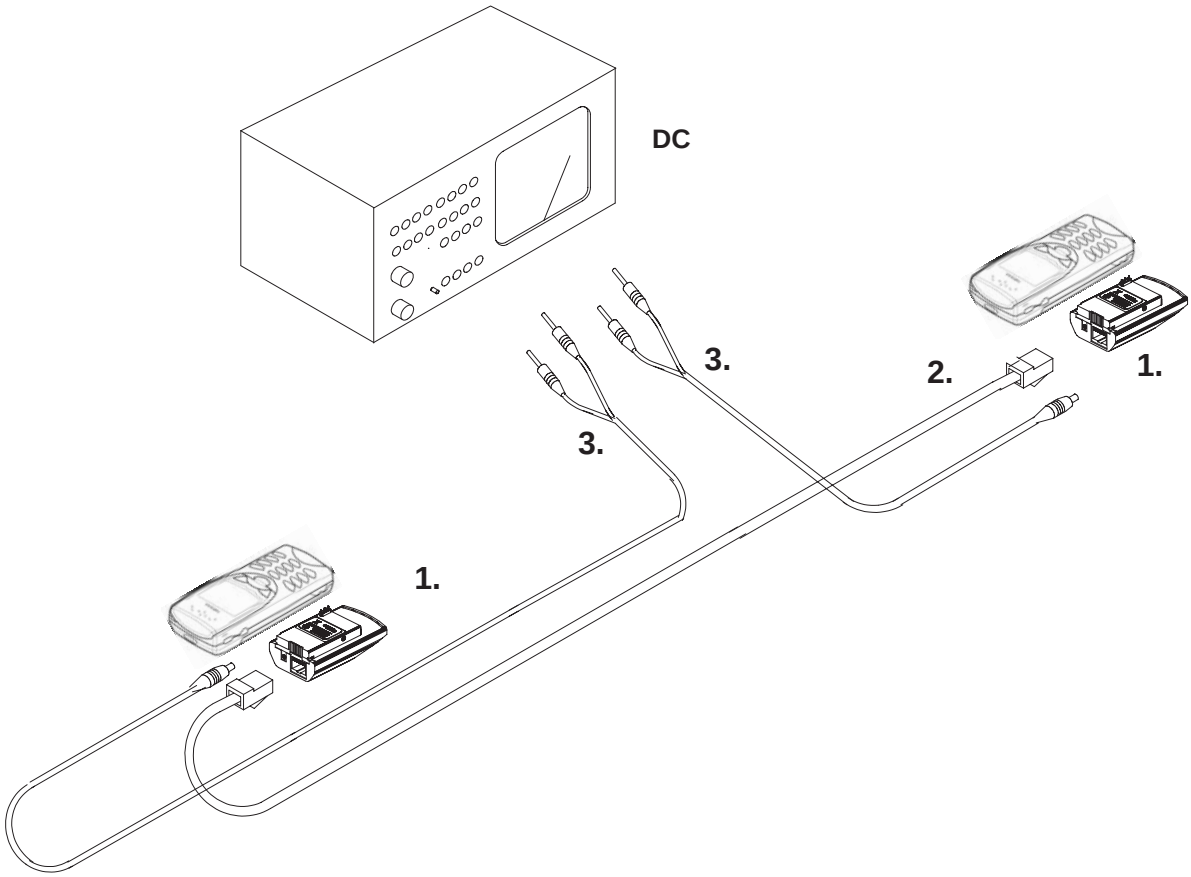
POS Flash Concept with FLA–10



Item:	Service accessory:	Product code:
1	Flash Loading Adapter FLA–10	0081346
2	Service Cable XMS–3	0730174
3	Travel Charger ACP–8 (see code: General Information chapter)	
4	D9–D9 Cable AXS–4	0730090
5	POS Flash Adapter FLS–2D	0774170
6	Service SW diskette 3.5” for NSM–3 (3D) Flash SW packages on CD	0774080 0775219

© Nokia Mobile Phones Ltd.

Warranty Transfer



Item:	Service accessory:	Product code:
1	Flash Loading Adapter FLA–10	0081346
2	Service Cable XMS–3	0730174
3	DC Power Cable FLC–2	0730185

© Nokia Mobile Phones Ltd.

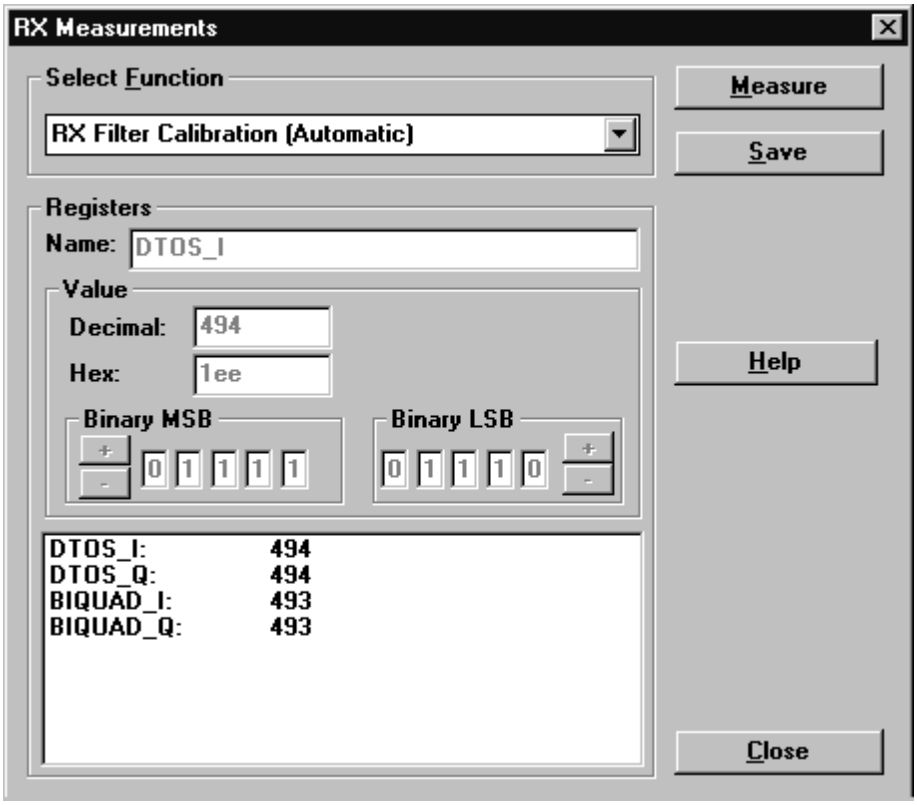
Tuning Steps

NOTE: All RF Tunings are made in Test Jig MJS–9.

1. RX Filter Calibration

BB–filter tuning is fully internal operation. External signal generators etc. are not needed, only command for phone to execute filter calibration procedure.

NOTE: RX Filter Calibration is needed when N505 has been changed.

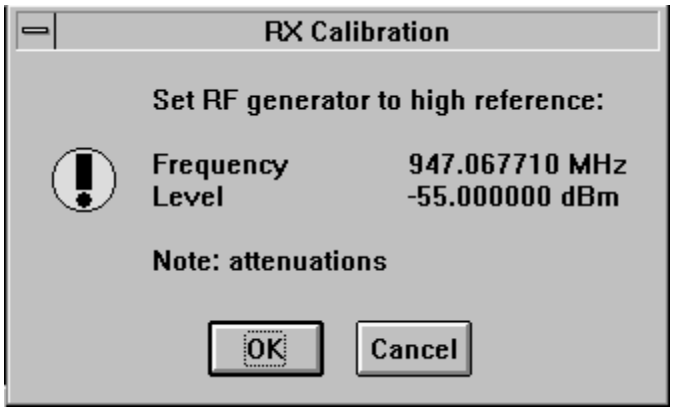


2. RX Calibration (AGC + AFC)

Procedure

Follow the steps described in chapter ”Service Software Instructions” section ”RX calibration... command”.

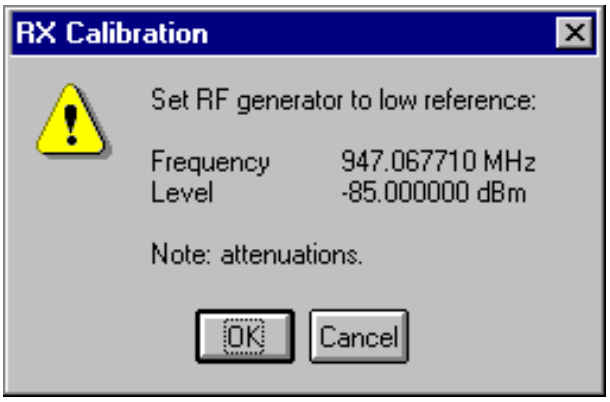
The measurement is done in five steps: 1. User is requested to put signal generator to high input level (read from .INI file).



© Nokia Mobile Phones Ltd.

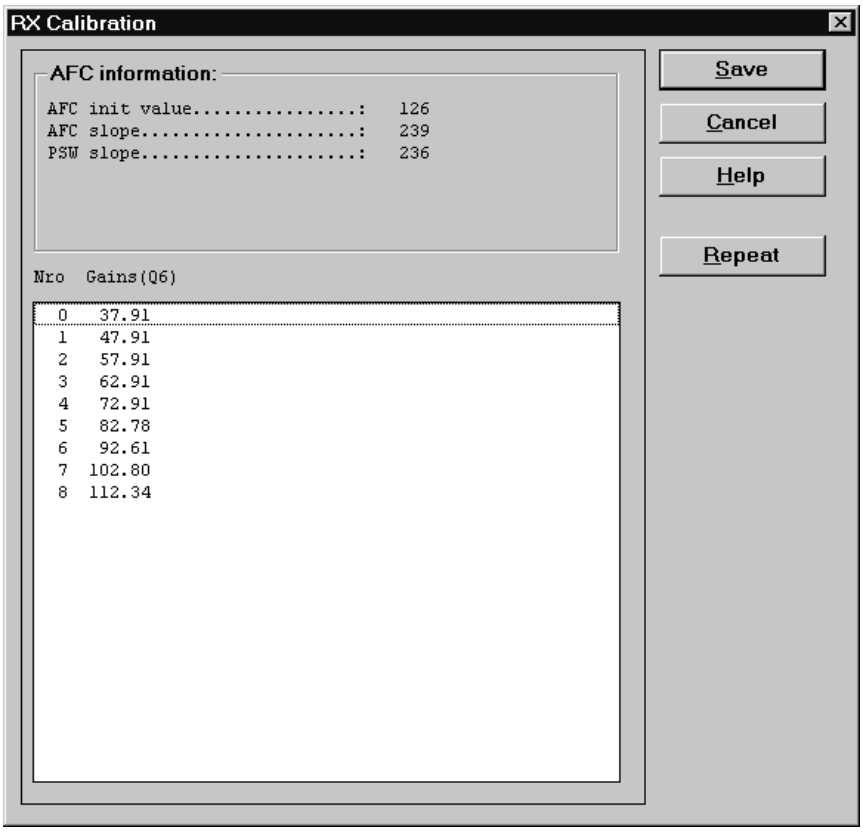
2. Measurement with high input level is executed

3. User is requested to put signal generator to low input level (read from .INI file).



4. Measurement with low input level is executed

5. The **RX Calibration** dialog will be updated when previous steps are done.



Software reports the following:

AFC init value
AFC slope
PSW slope
Gain step values

© Nokia Mobile Phones Ltd.

Limits for the reported values

After the calibration reported values should be **approximately** following:

Parameter	Low limit	High limit
AFC init value	–200	200
AFC slope	135	345
PSW slope	For information	

Gain step values	EGSM (nominal)	PCN (nominal)
0	37	28
1	47	38
2	57	48
3	62	53
4	72	63
5	82	73
6	92	83
7	102	93
8	112	103

Troubleshooting

If the calibration does not succeed the software normally reports ”Unable to read data from phone” or ”Failed to set high reference” or ”Failed to set low reference”.

In this case check first the basic functionality of the receiver chain: RF generator frequency set as in the calibration and level for example to the high reference value.

Then go to the RSSI reading menu (under RF controls). If the reading is very low there is something broken in the receiver and must be found by measuring voltages and signal levels at different places (information of these can be found elsewhere in this manual).

If the RSSI reading seems to be within 5 - 10 dB the same as the RF input level check that the VCTCXO frequency is close enough the wanted frequency. This is most easiest done by measuring VCO frequency in GSM middle channel 60 (VCO frequency is be 3788 MHz). If the deviation is bigger than about +/–50 kHz it is probable that the VCTCXO is not operating correctly.

If both of these (RSSI reading and the frequency) seem to be correct and calibration still fails the most probable reason is that there must be some missing gain step in Hagar or then the problem must be in Coppa.

© Nokia Mobile Phones Ltd.

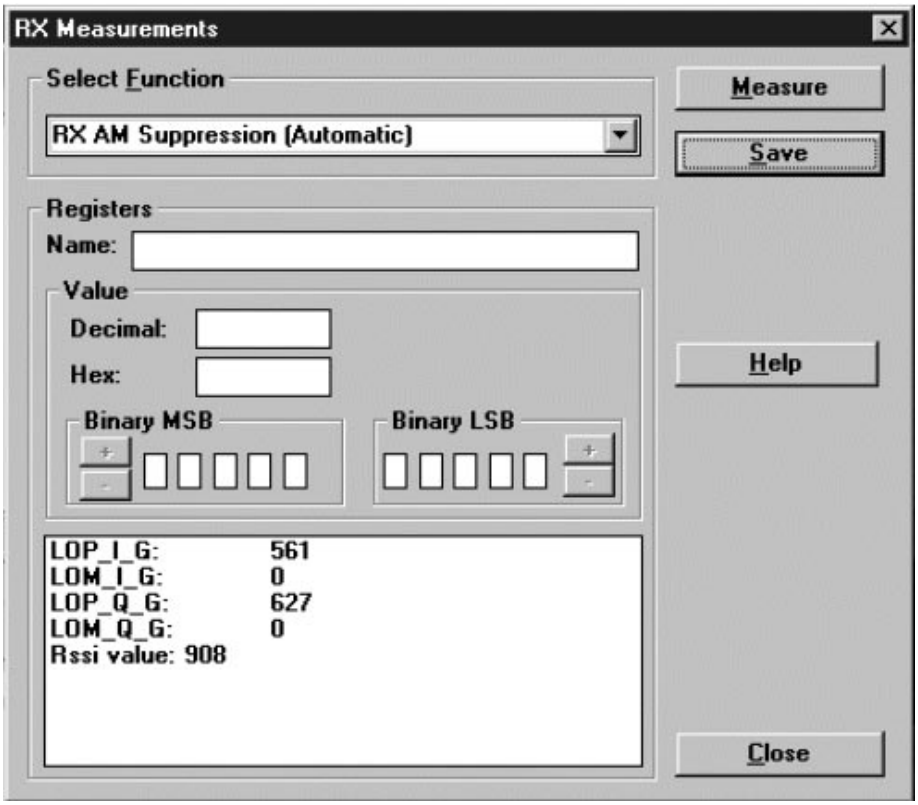
3. AM suppression tuning

This operation is recommended when RX components have been changed (between N505/Hagar and Z670/antenna switch).

AM suppression calibration is for tuning four Hagar parameters to get as small RSSI value as possible.

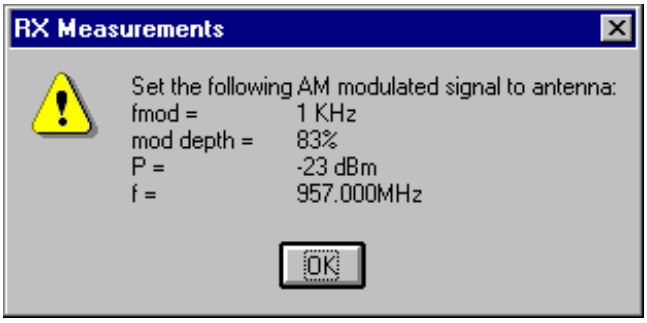
For AM–suppression calibration external signal generator with AM–modulation is needed.

Select *Am Suppression...* from *Tuning* menu.



Signal generator setup:
AM–modulation, fmod = 1 kHz, mod. depth = 83%
f = ch(default)+10 MHz,
P = –23 dBm (EGSM)
P = –26 dBm (PCN)

Press *Measure* button.



Press *OK* button.

© Nokia Mobile Phones Ltd.

Test limits for AM–calibr. results:
–86 dBm (EGSM)
–95 dBm (PCN)

Press *Save* button to save the values.

NOTE: AM suppression calibration is needed for the PCN band as well. To change the band go to *Product Menu* and select *Band*, *PCN.*

© Nokia Mobile Phones Ltd.

4. Alignment of Transmitter Power Levels

Equipment:

Pulsed power meter or spectrum analyzer and 10 dB attenuator. Voltage source set to 3.6 V.

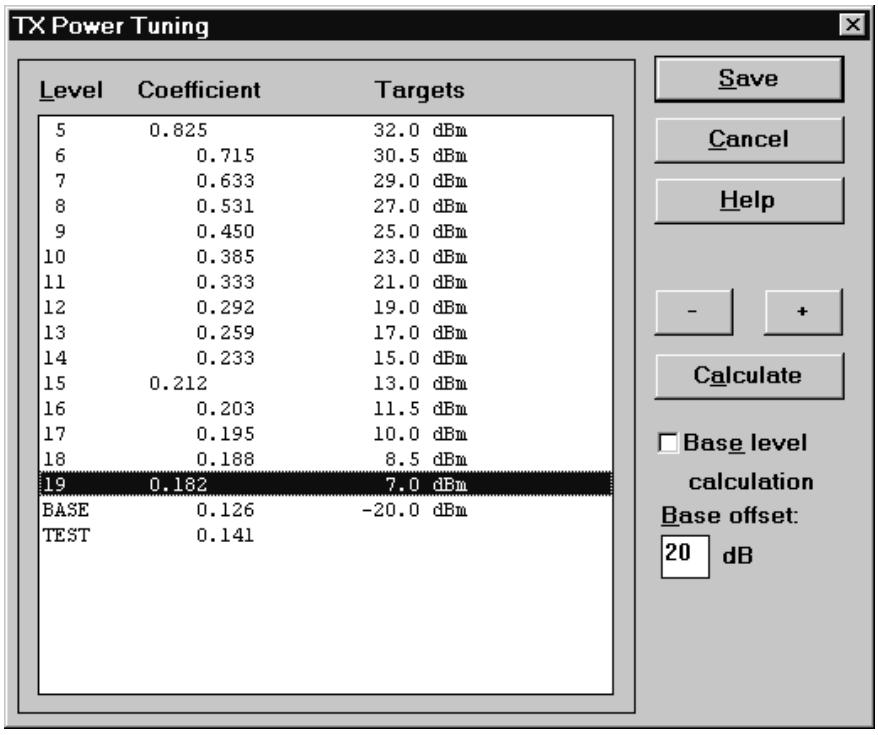
The following **settings** for the spectrum analyzer are recommended when aligning the power levels: zero span, resolution and video bandwidths 1 MHz, input attenuation 40 dB, sweep time 1 ms, video triggering.

NOTE! If spectrum analyzer is used in power level alignment the reading needs to be calibrated with a power meter after every power up. Check also the source voltage during TX burst with oscilloscope and use big enough capacitor.

Procedure:

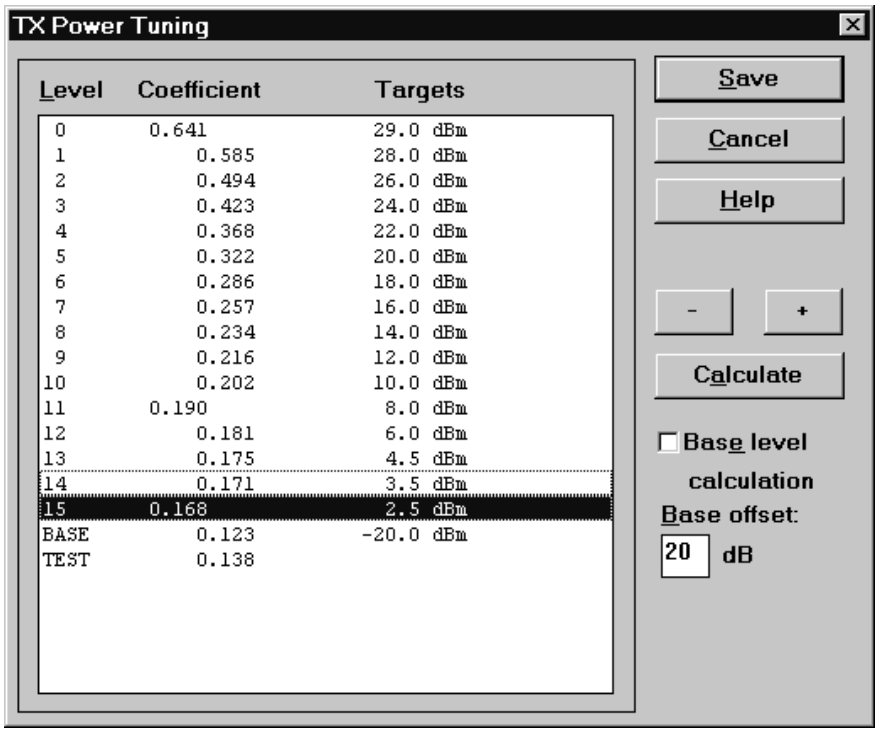
NOTE: Make sure you are working with GSM900 band. First tune power levels 5, 15 and 19. Then Calculate the other levels and save the values. After this switch to PCN band and do the tuning to levels 0, 11 and 15. (To change the band go to *Product Menu* and select *Band*, *PCN).* Then Calculate the other levels and save the values.

GSM900 TX Power Tuning dialog:



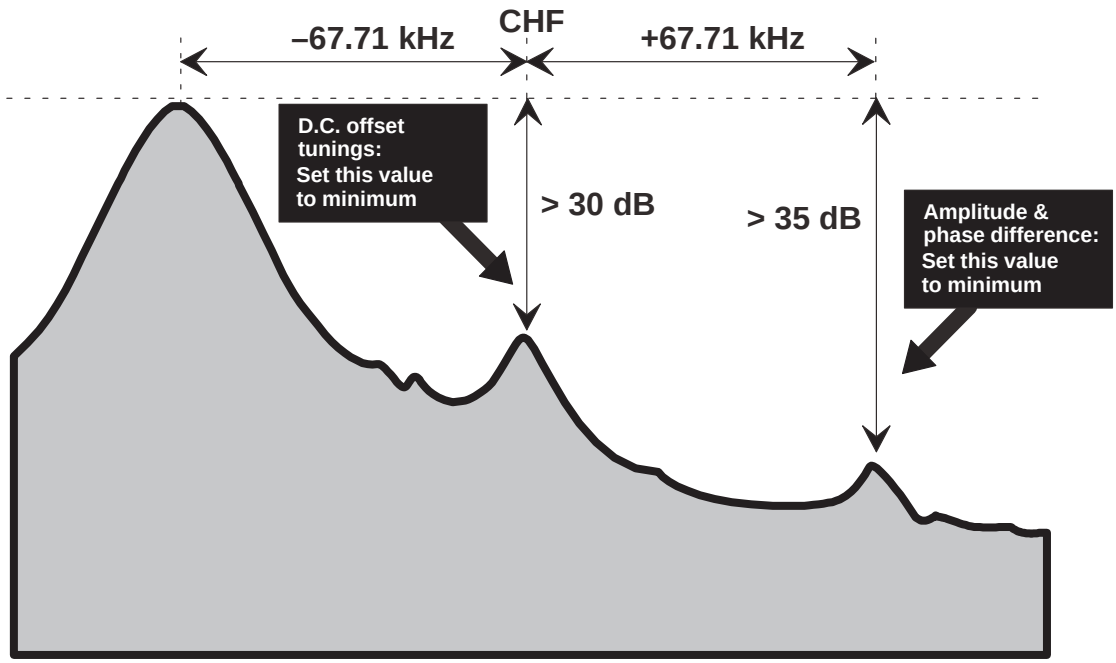
© Nokia Mobile Phones Ltd.

GSM1800 TX Power Tuning dialog:



5. I/Q Modulator Alignments

I/Q modulator alignments has to performed in both bands. See chapter ”Service Software Instructions” and section ”TX I/Q... command” for further information.


–67.71 kHz
CHF
+67.71 kHz
D.C. offset tunings: Set this value to minimum
> 30 dB
> 35 dB
Amplitude & phase difference: Set this value to minimum

© Nokia Mobile Phones Ltd.

Procedure:

Connect the spectrum analyzer to the phone antenna connector. The recommended spectrum analyzer settings are: span 200 kHz, resolution BW 10 kHz, video BW 1 kHz, sweep 500 ms, input attenuation 30 dB.

– From *RF controls* menu make sure that TX data type is 1.

– Go to *TX I/Q tuning* menu. The alignment channel for EGSM is 60 (902 MHz) and for PCN is 700 (1747.8 MHz).

– Select the ”TX I DC offset” option and adjust the level of the centre frequency (CHF) to minimum.

– Select the ”TX Q DC offset” option and adjust the level of the CHF again to minimum.

– After finding both minima change ”TX I DC offset” by step or two from the current value to both directions to see, whether better minimum can be found for CHF.

– Select the ”Amplitude Difference” option and adjust the level of the unwanted sideband CHF + 67.71 kHz to minimum.

– Select the ”Phase Difference” option and dajust the level of CHF + 67.71 kHz again to minimum.

– After all the minima have been found press ”Save” button to store the values to phone EEPROM.

Targets:

The level of the centre frequency CHF should be at least **30 dB** down to the wanted sideband CHF - 67.71 kHz.

The level of the unwanted sideband CHF + 67.71 kHz should be at least **35 dB** down to the wanted sideband CHF - 67.71 kHz.

© Nokia Mobile Phones Ltd.

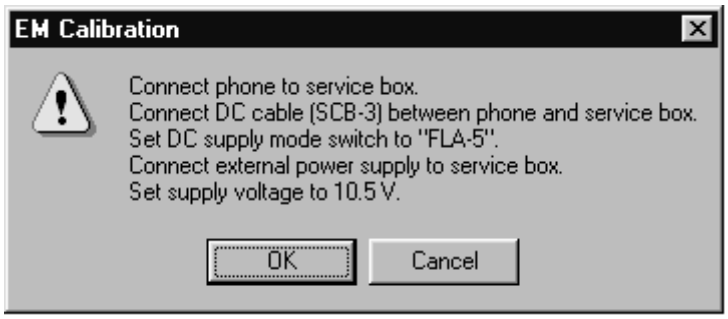
6. Energy Management Calibration

See section ”Tuning – Energy Management Calibration... command” for further information.

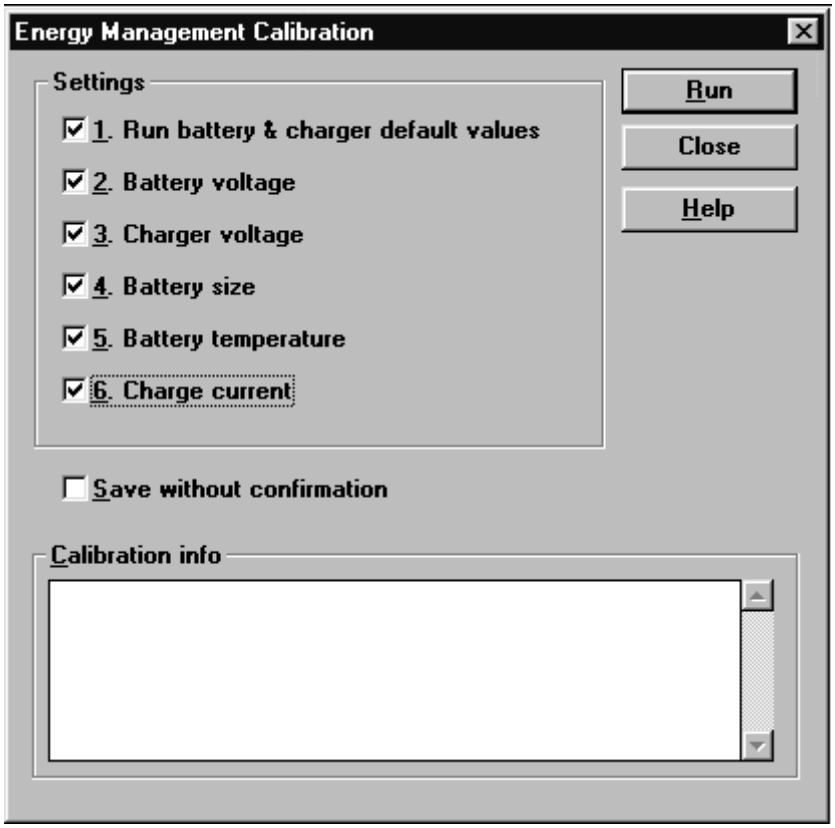
NOTE: This Calibration must be done when N100, N101 or a discrete component affecting these two is changed.

Before battery a/d tuning is started a voltage setting request is shown to user (Set supply voltage to 10,5 V). Service Battery is in this case JBU–6.

NOTE: Set DC Supply Mode in JBU–6 in FLA–5 (FLA–5/7) position! Remember to connect SCB–3 cable between Service Box JBU–6!


EM Calibration
Connect phone to service box.
Connect DC cable (SCB-3) between phone and service box.
Set DC supply mode switch to "FLA-5".
Connect external power supply to service box.
Set supply voltage to 10.5 V.
OK
Cancel

When external power is connected and user selects Yes to continue, the application displays the **Energy Management Calibration** dialog box:



© Nokia Mobile Phones Ltd.

Appendix 1, Vocabulary

Abreviation	Description
ASIC	Custom circuit which for instance controls communication between MCU and DSP
JBU–5	Service box
CLF	Common Look and Feel
CLI	Calling Line Identification
COBBA	Common Base Band Analog
DATA	DATA interface module
DAU–9S/P	MBUS/FBUS cable
DLL	Dynamic Link Library
DSP	Digital Signal Processor which controls radio interface and speech coding/decoding
EEPROM	Memory for adjustment parameters (Electrically Erasable and Programmable Read Only Memory)
FBUS	Fast serial bus
IMEI	International Mobile Equipment Identification code
IR	Infra Red transmitter
M2BUS	Serial communication bus which can be connected to accessory devices and test PC
MCU	Master Control Unit processor
MDI	MCU DSP Interface; message interface via ASIC registers
ME	Mobile Equipment
MODAL (dialog box)	A modal dialog box requires the user to complete interaction within a dialog box, and close it before continuing with any further interaction outside the window.
MODELESS (dialog Box)	A modeless dialog box allows the user to interact with other windows and applications.
MS	Mobile Station

© Nokia Mobile Phones Ltd.

PC	IBM PS/AT or compatible personal computer
PCI	Phone Controlling Interface SW for PC
PKD–1/1NS/1CS	Hardware protection key (DESKEY DK2) for protecting service software from illegal copying. The software will not work without this key !
RF	Radio Frequency parts
RTC	Real Time Clock
SW	Software
TDF–4	Flash security box
UI	User Interface

© Nokia Mobile Phones Ltd.

This page intentionally left blank.

© Nokia Mobile Phones Ltd.